United States
Department of
Agriculture

Soil
Conservation
Service

Cape May Court House,
New Jersey

1984 Annual Technical Report of the Cape May Plant Materials Center

A Summary of the North Atlantic Coastal Area Activities

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INTRODUCTION

This report covers the plant materials activities of the Cape May Plant Materials Center for the calendar years 1983-84. Established in 1965, the Cape May PMC is located approximately 24 miles south of Atlantic City, New Jersey on US Route 9. The property is comprised of a total of 88 acres. Four of these acres are deeded to the Federal Government and the balance is being used under a long term lease. The area served by the Center includes the mid-Atlantic coastal plain and the piedmont extending from Cape Cod, Massachusetts to Sunset Beach, North Carolina. The Major Land Resource Areas in each state are listed below:

Massachusetts
- 144A - New England and Eastern New York Upland, Southern Part
- 149B - Long Island, Cape Cod Coastal Lowland

Connecticut
- 144A - New England and Eastern New York Upland, Southern Part
- 145 - Connecticut Valley

New York
- 149B - Long Island - Cape Cod Coastal Lowland

New Jersey
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain
- 144A - New England and Eastern New York Upland, Southern Part

Maryland
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain
- 153B - Tidewater Area
- 153C - Mid-Atlantic Coastal Plain

Delaware
- 153C - Mid-Atlantic Coastal Plain

Virginia
- 133A - Southern Coastal Plain
- 136 - Southern Piedmont
- 153A - Atlantic Coast Flatwoods
- 153B - Tidewater Area
- 153C - Mid-Atlantic Coastal Plain

North Carolina
- 133A - Southern Coastal Plain
- 136 - Southern Piedmont
- 153A - Atlantic Coastal Flatwoods
- 153B - Tidewater Area

Purpose and Objectives of the Cape May PMC

To develop and promote the use of new and improved plants for the conservation of soil, water and related resources. To develop sound culture methods and management techniques for the effective use of plants and soils.

Functions

-- Collects and initially evaluates new plant materials to include native collections, foreign plant introductions and strains from plant breeders.

-- Increases potential new releases.

-- Makes advanced evaluations of selected accessions under simulated field conditions in comparison with a standard variety.
-- Determines cultural requirements of needed plant materials.

-- Makes field evaluation plantings on selected problem sites off the center, in order to obtain information of plants at sites typical of eventual use.

-- Provides plant propagules for field plantings in soil and water conservation districts where final evaluation of a new plant is made.

-- Jointly, names and releases new varieties with the New Jersey Agricultural Experiment Station.

-- After release, maintains and produces breeder or foundation seed or stock at the center in accordance with standards of the cooperating agency.

Tabular form data is not presented in this report for most projects under initial evaluation. This information can be made available upon request.

Note: Trade names used herein are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

DESCRIPTION OF AREA

The soils, topography, climate, and land use combine to produce a distinct plant resource area. The soil-forming materials include glacial outwash and underlying beds of sand, gravel, silt, and clay. Active sand dunes exist along the coast, wind erosion occurs on sandy cultivated fields, water erosion is a problem on sloping cropland and stream bank erosion threatens the tidal estuaries. The soils vary from excessively well drained to poorly drained and swampy. There are large tracts of tidal marsh around bays, river inlets and the ocean.

Topographic relief ranges from large areas of level or slightly sloping land to less extensive sections of moderately rolling ridges. The relatively level coastal plain rises from sea level to elevations of more than 600 feet in the piedmont. Level to gently undulating topography characterizes the coastal plain while in the piedmont gentle slopes and steep ridges are predominant.

The climate is tempered by the Atlantic Ocean. There are wide fluctuations in annual precipitation and to a lesser extent in temperature. Drought years do occur and tropical hurricane storms are common. Mean annual precipitation in the area ranges from 38 to 46 inches. The frost-free season varies from 170 to 250 days. Length of growing season is affected by latitude and elevation. Plant hardiness zones developed by the USDA, Agricutural Research Service are between zones 5 (-20^ to -10^F) and 9 (20^ to 30^F).

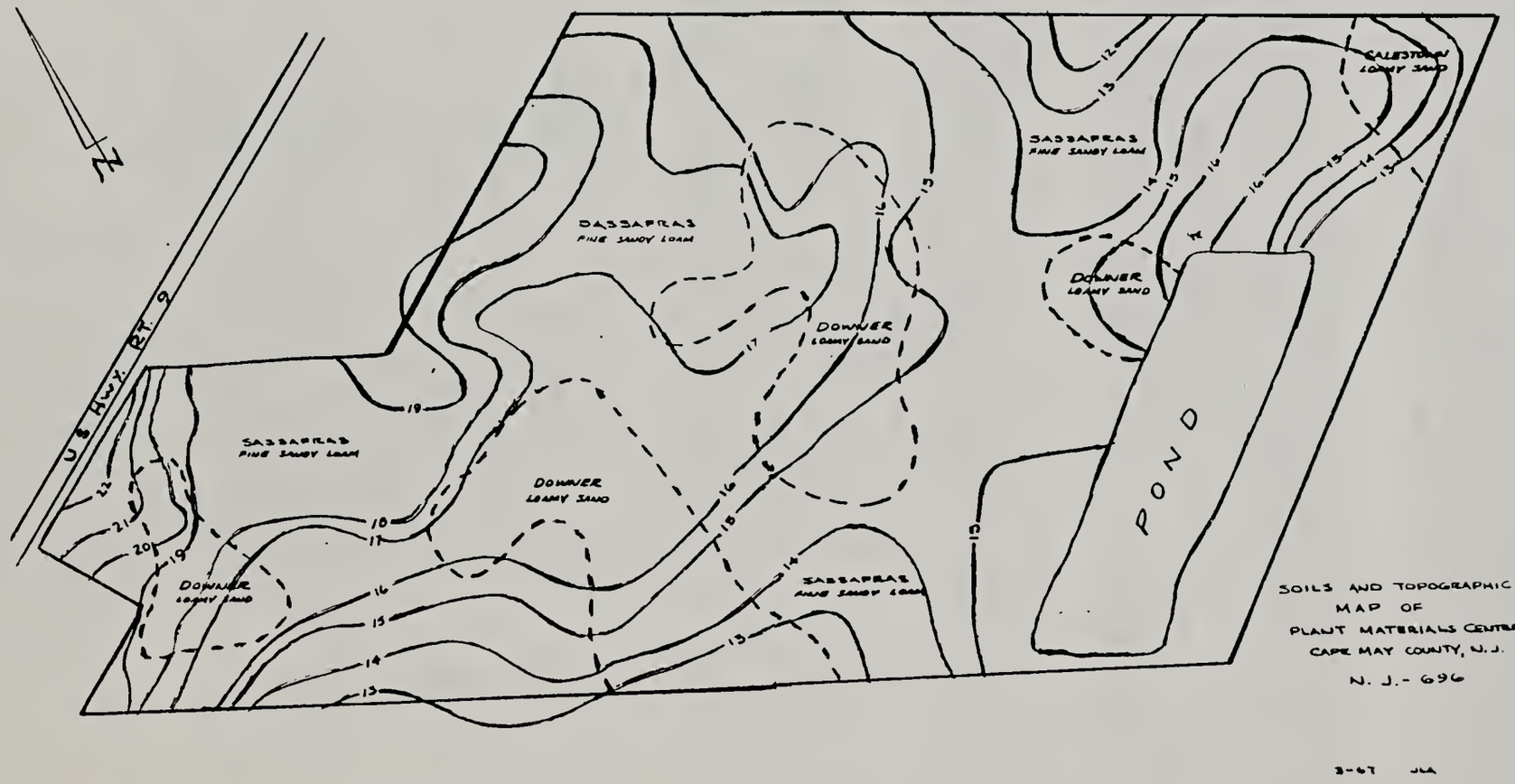
Agrciultural is predominantly cash row crops, orchards, truck crops, specialty crops, and poultry. There are large areas in hardwood and pine forests, much of which is neither managed for timber or wildlife. Extensive areas of tidal marsh are vital to the seafood and wildlife resources.

Fifteen percent of the nation's population lives within commuting distance of the area served by the Center, which creates demands for concentrated recreational facilities. An extensive summer resort industry has expanded into a year-round enterprise. Demand for space is so great that large areas of marshland are being considered for development which will intensify the pollution problem.

Non-agricultural activities play a dramatic role in the use of conservation plants. These include sand and gravel mining, expanding land transportation systems, increasing recreational facilities and industrial as well as residential developments.

Livestock enterprises have disappeared from many farms with a switch to continuous cultivated crops. This trend to cash crop operations has virtually eliminated hay and pasture plants from the cropping systems. Clean cultivation on large tracts of land has increased soil erosion. The problem is especially prevalent on large open areas of flat sandy soils and all sloping land during periods of less than adequate soil cover. Cropland erosion is high priority and the majority of the center's resources will be directed toward this need.

CAPE MAY PLANT MATERIALS CENTER PROPERTY



Soils and Elevation Map

Legend:

------ = Soil boundary.

15 = Elevation above sea level in feet.

Soils:

Sassafras - fine sandy loam

Downer - loamy sand

Galestown - loamy sand

DOWNER LOAMY SAND, 0 to 5 percent slopes

Nearly level to gently sloping well-drained soils that have a loamy sand surface and sandy loam subsoil. Natural fertility and available water holding capacity is moderate. Permeability is moderately rapid. This soil is subject to severe wind erosion when exposed in fields. Irrigation is generally needed when growing vegetable crops.

GALESTOWN LOAMY SAND, 0 to 5 percent slopes

This nearly level to gently sloping well-drained soil has a thick sand surface soil exceeding 20 inches. It has a sandy loam subsoil. Natural fertility is low and available water capacity is moderate. Sandy surface is droughty. Permeability is rapid in the upper 2 ft. and moderate in the sandy loam subsoil.

SASSAFRAS SANDY LOAM, 0 to 2 percent slopes

Nearly level well-drained soils that have sandy loam surface soils and sandy clay loam subsoils. It has medium natural fertility. This soil has moderate permeability and is subject to minor wind and water erosion. Irrigation is generally needed during extended dry periods.

Weather Records at Cape May Plant Materials Center for 1984

1984 Month	Air Temperature °F						4" Soil Temperature °F						Precipitation			
	Maximum			Minimum			Maximum			Minimum			Total	Devi-	Grtst.	No.
	Ext.	Av.	Deviation	Av.	Ext.		Ext.	Av.	Deviation	Av.	Ext.		Inches	ation	Daily	Days
Jan.	59	38	-2	-2	21	03	36	34	-5	-3	34	32	2.89	-0.46	1.46	7
Feb.	65	49	+7	+7	32	10	50	43	+4	+3	40	35	3.97	+0.72	.99	8
March	59	46	-4	-4	30	11	51	45	-1	0	42	37	7.48	+3.90	2.46	14
April	77	59	-1	0	41	26	63	56	0	0	50	43	5.26	+1.76	1.44	12
May	81	69	+1	+1	52	36	79	67	+1	0	60	49	8.05	+4.09	2.74	14
June	95	82	+4	+2	62	43	83	78	+2	+2	72	60	1.89	-1.50	.81	8
July	95	83	0	-1	64	54	87	82	0	0	76	72	2.71	+0.08	.98	10
Aug.	94	86	+3	+1	66	52	97	86	+5	+3	79	72	.83	-2.99	.57	7
Sept.	95	78	+1	-3	55	40	85	77	+1	0	71	67	.93	-1.57	.55	8
Oct.	83	71	+6	+6	52	34	71	67	+2	+3	64	59	2.80	-0.71	1.02	8
Nov.	71	56	+4	-3	36	21	68	55	+1	0	51	42	2.83	-0.68	.98	5
Dec.	74	50	+4	+1	30	18	54	48	+3	+4	46	42	1.58	-2.37	1.06	6
1984	95	64			45	03	97	62			57	32	41.22	+0.27		107
Normal*		62			45			60			56		41			

*Normal based on:

19 yr. Air Temperature Average; 15yr. Soil Temperature Average; 19 yr. Precipitation Ave.

Frost free days 208 - April 12 to Nov. 7, 1984 - Normal 191 days.

6.8 inches of snow fell between January 11 and March 13.

PERSONNEL

Manager	Cluster R. Belcher (until Nov. 12, 1984)
Acting Manager	Donald W. Hamer (from Nov. 12, 1984)
Soil Conservationist	Philip L. Koch (Until May 9, 1984)
Soil Conservationist	Noel J. Murray (from Aug. 13, 1984)
Foreman	Wilson J. Merrick
Secretary	Barbara A. Turnier
Soil Conservation Aids (WAE)	Curtis Erichson
	James Layton
	Ed Hiller

CAPE MAY PMC STATE CONSERVATIONISTS' ADVISORY COMMITTEE

Joseph C. Branco, NJ State Conservationist

Coy A. Garrett, NC STC

Manly S. Wilder, VA STC

Other Specialists

W. Curtis Sharp, NENTC Plant Materials Specialist

Frank H. Webb, NJ Plant Materials Specialist
(until 8/15/84)

Cluster R. Belcher, NJ Plant Materials Specialist
(from 11/12/84)

Stephen K. Salvo, NC Plant Materials Specialist

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REGISTRATION OF SEA ISLE JAPANESE SEDGE

C. R. Belcher, F. H. Webb, R. W. Duell, and W. C. Sharp (4)

REGISTRATION OF SEA ISLE JAPANESE SEDGE

'SEA ISLE' Japanese sedge (*Carex kobomugi* Ohwi) (Reg. no. 94) was developed by the Soil Conservation Service (SCS), USDA, and jointly released in 1983 by the SCS and the New Jersey Agricultural Experiment Station.

Japanese sedge is an introduced species that has become established at several locations along the mid-Atlantic coast from New Jersey to North Carolina. The first recorded observation of Japanese sedge in the United States was at Island Beach State Park, New Jersey, in the 1920's (3). The stand at Island Beach is one of the most extensive naturalized stands in the United States.

The original plants of Sea Isle were collected from Island Beach State Park, New Jersey, in 1965. Although several plants were collected, it is believed the material represented a single clone. The collection was designated NJ-406 and later PI-433953.

In the 1960's, Japanese sedge was collected from three other sites in the United States. Comparison of these to PI-433953 did not show striking differences. PI-433953 generally rated better for vigor and overall performance. It was significantly superior to one foreign introduction.

Sea Isle is a low-growing, leafy, slowly spreading, perennial sedge. Its grass-shaped leaves are leathery and range from 4 to 10 mm wide. Plants spread slowly by short, stout, sharp tipped rhizomes. Mature canopy height seldom exceeds 0.35 m (2). The leaf size and shape, plant height, and spreading ability of Sea Isle Japanese sedge are typical of other colonized accessions that were tested.

Sea Isle produces seed, but most natural propagation is vegetative. In germination trials, few seedlings emerged, and those that did exhibited poor vigor. All propagation of Sea Isle for increase or evaluation has been by vegetative means. Mortality following transplanting is sometimes high (1); the surviving plants, however, persist and spread slowly into dense stands.

The principal use of Sea Isle Japanese sedge is for long-term stabilization of coastal sand dunes. Plantings can be made by interplanting with or into existing stands of American beachgrass (*Ammophila breviligulata* Fern.). The preferred method in new plantings is alternate rows of Sea Isle with rows of the beachgrass. Beachgrass will initially stabilize the area, and Sea Isle will fill in as American beachgrass becomes sparse in later years. Sea Isle is more resistant to pests and longer-lived on low fertility dune plantings in the mid-Atlantic area than American beachgrass. Its sharp tipped rhizomes discourage barefoot traffic. It is, however, more wear-tolerant than beachgrass, making it a desirable alternative on frontal dunes in areas subject to traffic.

Field tests show Sea Isle to be well adapted to Long Island, New York, and southward through South Carolina. Additional plantings are being conducted to determine its adaptation to more northern and southern locations.

Breeder culms of Sea Isle will be maintained by the SCS on a sand dune site near Cape May, New Jersey. Foundation culms are available from the Cape May Plant Materials Ctr., Cape May Court House, NJ 08210.

C. R. BELCHER, F. H. WEBB, R. W. DUELL, AND W. C. SHARP (4)

References and Notes

1. Gleason, H.A., and A. Cronquist. 1963. Manual of vascular plants of Northeastern United States and adjacent Canada. D. Van Nostrand Co., NY p. 159.
2. Hawks, V.B. and W.C. Sharp. 1967. Sand dune stabilization along the North Atlantic Coast. J. Soil Water Conserv. 22 (4):143–146.
3. Small, J.A. 1954. *Carex kobomugi* at Island Beach, New Jersey. Ecology. 35 (2):289–291.
4. Manager, USDA-SCS, Cape May Plant Materials Ctr., Box 236-A, RD #1, Cape May Court House, NJ 08210; New Jersey plant materials specialist, USDA-SCS, 1370 Hamilton Street, Somerset, NJ 08873; associate research professor, Soils and Crops Dep., New Jersey Agric. Exp. Stn.; Natl. Technical Ctr. plant materials specialist, USDA-SCS, 160 E. 7th Street, Chester, PA 19013. Publication no. D-15455-1-84; New Jersey Agric. Exp. Stn., Cook College, Rutgers Univ., New Brunswick, NJ 08903. Registration by the Crop Sci. Soc. of America. Accepted 25 June 1984.

SOIL CONSERVATION SERVICE
CAPE MAY PMC
PROJECT PLAN

I. PROJECT TITLE: Evaluation of Annual Species for Windbreaks
PROJECT NO: 34I056K

Wind erosion has been identified as a serious problem within the Cape May Service Area for some time. Up to this date, it has been difficult to decide how to approach a solution. Several species have been identified as potential windbreak types, yet, few non-woody plants have proved satisfactory for testing. The center will be evaluating several types of windbreaks to include arrangement, species and primary crop species.

II. PROBLEM:
The problem is twofold. The most serious aspect is airborne movement of sand during periods of sparse cover. The source areas are scoured while sand may be transported to undesirable locations, such as, field borders, roads, or farmsteads. Sand particles can injure young plants as they are transported from one location to another. This injury may be in the form of plant abrasion, breaking of the plant stems, uprooting, or overtopping of juvenile plants.

Currently, the recommended windbreak systems and species are not fully accepted by farmers. The need exists for temporary windbreak species for use in MLRA 133A, 145, 149, 153A, B&C.

III. OBJECTIVES:
The objective is to evaluate several annual species for temporary windbreaks. If a non-commercial variety proves to be the best, this accession will be cooperatively released as a cultivar for use in the area of need.

IV. LITERATURE REVIEW:

V. PROCEDURE:

A. Assembly: 1984-85

The assembly will be from National PMC sources, commercial seed companies and other avenues.

1. Species:
   a. Sorghum sudaneses (sudan grass)
   b. S. vulgare (sorghum)
   c. Triticum aestivum (wheat)
   d. Secale cereale (rye)
   e. Zea mays (corn)
2. Sample Size: 5 lbs.
3. No. of Accessions: 5 from each species

B. Initial Evaluation:
1. Location: Cape May PMC F-12
2. Soils: Sassafras silt loam
3. Planting Plan:
   a. Plot design: Multi-row, non-replicated plots.
   b. Plot size: 3-5 narrowly spaced rows, 50 feet long.
   c. Row orientation: Perpendicular to prevailing winds.
   d. Seeding rates: Full recommended rate for species and 1/2 that rate.
   e. Method: Planet Jr.
   f. Date: Normal for species
      (1) Small grain - Oct. 1
      (2) Other - May 1-15
   g. Standard: 'Aroostook' rye
   h. Duration: 1 Year
      Plantings will be duplicated over a 3-year-period.
4. Managment:
   a. Seedbed: Plow and till to provide a weed-free planting surface; firm seedbed before planting.
   b. Fertility: Apply fertilizer based on soil analysis results for good plant growth.
   c. Pest Control:
      (1) Weeds will be controlled mechanically.
      (2) Insects will be controlled as needed.
   d. Irrigation: Will apply water to maintain adequate moisture.
5. Plant Evaluations:
   a. Vigor (1-10)
      (1) 30 days after planting
      (2) 60 days after planting
      (3) 90 days after planting
   b. Plant height (cm)
      (1) Oct.
      (2) Dec.
      (3) Feb.
      (4) April
   c. Windbreak density (1-10)
      Recorded at spring planting date
   d. Porosity of windbreak (open-closed)

e. Lodging (1-10)
   (1) Oct.
   (2) Dec.
   (3) Feb.
   (4) April
f. Animal damage
g. Other pertinent factors

C. Selection:
   The superior accession (or species) will be selected for advanced testing.

D. Initial Seed Increase:
   If the superior accession is a commercial variety, seed will be purchased. In the event the best accession is not commercially available, a breeeders block of this accession will be established for a seed source. This block will be used to produce seed for advanced testing and for genetic quality.

E. Advanced Evaluation:
   Advanced and final testing will be conducted off-center in field size units.

IV. COOPERATION:
   Agronomy and Soils Department, Cook College, Rutgers.

Cover Crop Assembly

34I039M

The assembly for the superior winter cover crop project began in 1983. Approximately, 1,000 accessions representing 20 different species were collected during that year. These accessions included Medicago spp., Trifolium spp., Vicia spp., Bromus spp., Lolium spp., and Brassica spp. In September of 1983, 300 of these accessions, mostly Medicago species were planted for initial evaluation or initial seed increase.

In 1984, 200 of the 300 accessions planted in 1983 were considered as having potential for providing effective winter soil cover. Seed was harvested from these and replanted in addition to another 1,000 accessions making a total of 1200 accessions in initial evaluation. Assistance in planting and evaluating a portion of this vast assembly is being provided by the National Plant Materials Center at Beltsville, Maryland.

The objective of this project is to select and release a winter hardy cover crop cultivar. The use of this cultivar will be primarily for conventionally tilled soybean fields, silage land and land used to grow speciality crops such as tobacco, peanuts and vegetables. Ideally, this cultivar would be adapted to overseeding into a standing crop and not interfere with harvest operations while providing adequate cover before freezing temperatures stop growth.

Alternately, a cold tolerant cultivar which could be seeded after crop harvest is also desirable.

Juniperus virginiana for Screens and Windbreaks

34I004K

Extensive damage to numerous crops occurs annually in New Jersey and other coastal states when high velocity winds blow across the land. People, animals and buildings are also affected. Soil texture, field width and condition of the soil surface are the primary factors associated with this erosion problem. Fine soil particles begin to blow when a wind of 12 to 15 miles per hour is attained 1 foot above the ground surface. Therefore, to prevent or contol wind erosion, it is neccessary to reduce the wind velocity to a non-erodible rate for the given soil, and/or attain a protective condition on the soil surface. Properly established windbreaks can decrease wind erosion on barren cropland during all seasons.

Several woody species have been used and a few are recommended for windbreaks on inland sites. Many of these are deciduous but evergreens such as *Juniperus virginiana* (Eastern red cedar) can be effective. This native species is also used by homeowners for screening purposes.

J. virginiana is partially salt tolerant and has been planted and successfully grown on secondary sand dunes. Since this species is adapted to a variety of soil and climatic conditions, it has a large range of adaptation.

This project was started by collecting seed from approximately 50 locations in several coastal states. The first planting was made in the fall of 1975.

Seedlings of this species are variable in growth rate and form. Some plants in the windbreak have exhibited good growth while others increased very little in height. The growth form varies from columnar to almost oval. The objective of this project is to evaluate the species for a fast growing strain that has dense foliage and columnar form. Because of the variability of the seedlings, vegetative propagation is under consideration. Otherwise, additional selections may be required.

Panicum amarum

34I034C

Panicum amarum (bitter panicgrass) is a perennial warm season grass which spreads by underground rhizomes. It has a semi-prostrate growth form and supplements other sand dune species, such as Ammophila breviligulata (American beachgrass) and Uniola paniculata (sea oats). Bitter panicgrass is relatively easy to establish by transplanting and is well adapted to the foredunes from Connecticut to Texas. It usually persists where stands of A. breviligulata deteriorates, making it a valuable plant when used on the frontal and back dune areas. The probable area of adaptation for bitter panicgrass is Maryland and southward.

The Cape May PMC staff made an assembly of bitter panicgrass in 1983 by collecting fifty seven accessions in various states. This spring, forty-two accessions were planted for initial evaluation. While many of the accessions exhibited fair to good vigor, two accessions from North Carolina (T-39029 and T-39030) were outstanding.

The objective of the project is to select a superior accession which is adapted to MLRA 153 and release a cultivar. Its primary purpose will be to supplement other dune vegetation on sand dunes. Bitter panicgrass is platable to livestock, but is not currently being tested for that purpose.

Pine Crosses USDA-NJ-SCS

FINAL REPORT

34I035W

Pinus rigida (pitch pine) is a hardy yellow pine that grows as far north as Maine. However, its rate of growth and form are poorer than P. taeda L. (loblolly pine). Foresters have been interested in the possibility of combining the rate of growth and form for loblolly with the winter hardiness of pitch pine. The study started in 1963 by the Northeastern Forest Experiment Station and WESTVACO assisted by other interested agencies.

Test plantings of hybrids between selected clones of pitch pine and loblolly have been made in several states. Not only do certain hybrids combine loblolly's rate of growth and form with pitch pine's winter hardiness, but their fibrous root system apparently permits rapid growth on droughty sites or strip-mined areas.

The Cape May PMC became involved in 1982 with the establishement of a test plot of the pitch-loblolly hybrid as a demonstration project at the center. The greenhouse grown crosses were planted on the center during April. Within two weeks, many of the needles had turned brown, particularly near the bottom of each plant. It is suspected that the plants were not properly hardened off after removal from the greenhouse. Survival, vigor, pest damage, growth rate and winter hardiness were evaluated. Survival and vigor were rated poor at the end of this first year.

Two years after establishment, the few accessions which retained good survival were also rated as having less than average vigor. The poor vigor may have contributed to insect damage by the pine tip moth. Low winter temperatures also may have killed additional plants already in a weakened state. Due to the poor survival and vigor, there will not be any further evaluations made for this pine cross project.

Table 1

Pine crosses height and width, 1983 [1/]

Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)	Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)
62 x 4-32	1	10	20	Pitch	1	25	30
	2	- [2/]	-	Plains	2	-	-
I-1-1	3	-	-	I-1-7	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	10	15		6	-	-
4762	1	5	10	Loblolly	1	40	35
	2	5	5		2	-	-
I-1-2	3	5	10	I-1-8	3	40	30
	4	5	10		4	55	35
	5	5	10		5	25	15
	6	5	10		6	35	35
AxD	1	-	-	75x22	1	-	-
	2	15	20		2	5	15
I-1-3	3	-	-	I-1-9	3	20	20
	4	15	10		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
AxD	1	-	-	AxD	1	10	5
	2	20	25		2	10	15
I-1-4	3	20	25	I-1-10	3	-	-
	4	15	15		4	10	10
	5	15	15		5	10	10
	6	-	-		6	-	-
AxD	1	10	15	62x23	1	-	-
	2	-	-		2	15	20
I-1-5	3	15	25	I-1-11	3	35	35
	4	10	15		4	20	10
	5	-	-		5	15	10
	6	-	-		6	25	10
4756	1	5	5	AxD	1	-	-
	2	5	5		2	-	-
I-1-6	3	10	10	I-2-1	3	-	-
	4	10	15		4	-	-
	5	5	10		5	10	20
	6	10	15		6	10	5

Table 1

Pine crosses height and width, 1983

Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)	Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)
62x22	1	20	25	65x4-32	1	10	30
	2	5	5		2	10	20
I-2-2	3	15	20	I-2-8	3	10	20
	4	15	25		4	15	25
	5	-	-		5	-	-
	6	-	-		6	15	20
67x22	1	10	15	80x6-22	1	20	15
	2	-	-		2	20	20
I-2-3	3	-	-	I-2-9	3	20	20
	4	10	10		4	15	30
	5	5	20		5	30	30
	6	-	-		6	-	-
77x23	1	20	20	AxD	1	5	10
	2	15	15		2	-	-
I-2-4	3	15	35	I-2-10	3	-	-
	4	15	30		4	10	10
	5	-	-		5	-	-
	6	15	25		6	-	-
77x4-32	1	15	15	80x11-9	1	25	25
	2	15	25		2	-	-
I-2-5	3	10	20	II-2-11	3	20	15
	4	10	10		4	25	40
	5	25	25		5	-	-
	6	30	35		6	-	-
65x15A	1	5	20	77x4-32	1	15	5
	2	10	25		2	10	5
I-2-6	3	10	10	II-2-12	3	15	15
	4	20	30		4	15	10
	5	15	15		5	10	10
	6	15	25		6	5	5
65x23	1	5	15	77x23	1	-	-
	2	10	20		2	-	-
I-2-7	3	15	20	II-3-1	3	-	-
	4	15	25		4	-	-
	5	15	15		5	-	-
	6	20	25		6	-	-

Table 1

Pine crosses height and width, 1983

Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)	Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)
4759	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
II-3-2	3	-	-	II-3-8	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
71x4-32	1	15	20	AxD	1	-	-
	2	-	-		2	-	-
II-3-3	3	-	-	II-3-9	3	-	-
	4	-	-		4	-	-
	5	10	15		5	-	-
	6	15	20		6	-	-
76x15A	1	15	20	65x15A	1	-	-
	2	15	25		2	-	-
SOP	1	-	-	II-3-10	3	-	-
	2	-	-		4	-	-
II-3-4	3	-	-		5	-	-
	4	-	-		6	-	-
AxD	1	5	15	62x23	1	-	-
	2	-	-		2	-	-
II-3-5	3	5	5	II-3-11	3	-	-
	4	20	20		4	20	25
	5	-	-		5	15	20
	6	-	-		6	-	-
Loblolly	1	-	-	AxD	1	15	10
	2	35	35		2	10	10
II-3-6	3	-	-	II-3-12	3	5	5
	4	30	30		4	5	5
	5	40	40		5	-	-
	6	-	-		6	-	-
AxD	1	10	5	4769	1	5	5
	2	-	-		2	5	10
II-3-8	3	-	-	II-4-1	3	5	5
	4	-	-		4	15	5
	5	-	-		5	10	10
	6	-	-		6	-	-

Table 1

Pine crosses height and width, 1983

Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)	Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)
78x6-42	1	15	10	AxD	1	10	20
	2	15	20		2	20	15
II-4-2	3	-	-	III-4-9	3	-	-
	4	-	-		4	-	-
	5	-	-		5	15	10
	6	15	15		6	10	5
65x4-32	1	20	20	71x11-20	1	15	5
	2	15	15		2	-	-
II-4-3	3	-	-	III-4-10	3	15	15
	4	15	15		4	-	-
	5	20	30		5	15	10
	6	20	20		6	5	15
65x23	1	-	-	65x11-20	1	-	-
	2	-	-		2	10	20
II-4-4	3	15	25	III-4-11	3	15	20
	4	15	15		4	20	15
	5	-	-		5	15	10
	6	-	-		6	10	10
62x4-32	1	10	15	Pitch Plains	1	-	-
	2	-	-		2	10	25
II-4-5	3	-	-	III-4-12	3	-	-
	4	-	-		4	-	-
	5	-	-		5	20	25
	6	15	20		6	-	-
78x23	1	10	10	65x23	1	-	-
	2	-	-		2	10	10
II-4-6	3	5	15	III-4-13	3	15	10
	4	-	-		4	-	-
	5	10	15		5	-	-
	6	10	10		6	5	15
AxD	1	10	15	65x15A	1	10	15
	2	10	10		2	-	-
II-4-7	3	5	5	III-4-14	3	-	-
	4	10	15		4	-	-
	5	15	15		5	15	20
	6	15	15		6	-	-
AxD	1	15	15	62x4-32	1	5	5
	2	15	20		2	10	10
III-4-8	3	-	-	III-4-15	3	-	-
	4	10	15		4	15	15
	5	10	15		5	-	-
	6	20	15		6	15	30

Table 1

Pine crosses height and width, 1983

Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)	Accession Rep/Row Position	Plant No.	Height (cm)	Width (cm)
78x4-32	1	-	-	AxD	1	10	15
	2	20	20		2	15	20
III-5-1	3	20	25	III-5-8	3	5	10
	4	15	20		4	10	10
	5	5	20		5	5	10
	6	-	-		6	-	-
65x4-32	1	10	15	AxD	1	-	-
	2	-	-		2	5	5
III-5-2	3	10	10	III-5-9	3	5	5
	4	20	10		4	5	5
	5	-	-		5	5	10
	6	10	15		6	5	5
Loblolly	1	30	30	78x23	1	10	25
	2	30	30		2	10	25
III-5-3	3	25	30	III-5-10	3	-	-
	4	45	40		4	-	-
	5	35	30		5	10	25
	6	45	40		6	5	15
AxD	1	20	15	4756	1	-	-
	2	-	-		2	5	10
III-5-4	3	20	25	III-5-11	3	-	-
	4	10	10		4	5	10
	5	-	-		5	5	10
	6	5	55		6	10	10
4769	1	5	5	77x4-32	1	5	15
	2	5	10		2	5	15
III-5-5	3	5	10	III-5-12	3	10	15
	4	10	10		4	-	-
	5	5	10		5	10	20
	6	10	5		6	15	10
62x11-10	1	15	20	79x7-56	1	20	20
	2	20	15		2	20	20
III-5-6	3	-	-	III-5-13	3	25	25
	4	-	-		4	20	20
	5	25	15		5	20	25
	6	25	25		6	20	25
AxD	1	5	5				
	2	15	15				
III-5-7	3	5	15				
	4	15	15				
	5	10	15				
	6	20	20				

1/Six plants/accession (except 76x15A and SOP in Rep II) planted April 20 to May 13, 1982; Data recorded March 17.
2/A dash (-) indicates a dead plant.

Table 2

Height and pest damage for hybrid pines, 1984 [1/]

Accession Rep/Row/ Position	Plant No.	Height (cm) [2/]	Pest Damage [3/]	Accession Rep/Row Position	Plant No.	Height (cm)	Pest Damage
62x4-32	1	-	-	Pitch pine	1	45	3
	2	-	-		2	-	-
I-1-1	3	-	-	I-1-7	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
4762	1	10	1	Loblolly	1	70	3
	2	-	-		2	-	-
I-1-2	3	-	-	I-1-8	3	80	3
	4	10	1		4	100	3
	5	10	1		5	-	-
	6	-	-		6	65	3
AxD	1	-		72x22	1	-	-
	2	30	3		2	-	-
I-1-3	3	-	-	I-1-9	3	50	3
	4	25	1		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
AxD	1	-	-	AxD	1	15	1
	2	35	3		2	10	1
I-1-4	3	25	3	I-1-10	3	-	-
	4	25	2		4	-	-
	5	20	3		5	25	1
	6	-	-		6	-	-
AxD	1	-	-	62x23	1	-	-
	2	-	-		2	-	-
I-1-5	3	30	-	I-1-11	3	-	-
	4	25	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
4756	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
I-1-6	3	10	3	I-2-1	3	-	-
	4	10	1		4	-	-
	5	-	-		5	30	4
	6	-	-		6	-	-

Table 2
(cont.)

Height and pest damage for hybrid pines, 1984

Accession Rep/Row/ Position	Plant No.	Height (cm)	Pest Damage	Accession Rep/Row Position	Plant No.	Height (cm)	Pest Damage
62x22	1	35	1	65x4-32	1	5	3
	2	-	-		2	30	3
I-2-2	3	50	1	I-2-8	3	50	3
	4	30	1		4	45	4
	5	-	-		5	-	-
	6	-	-		6	35	4
67x22	1	20	2	80x6-22	1	30	1
	2	-	-		2	50	4
I-2-3	3	-	-	I-2-9	3	55	4
	4	25	1		4	50	4
	5	25	3		5	50	4
	6	-	-		6	-	-
77x23	1	35	2	AxD	1	15	3
	2	-	-		2	-	-
I-2-4	3	-	-	I-2-10	3	-	-
	4	35	2		4	25	3
	5	-	-		5	-	-
	6	30	3		6	-	-
77x4-32	1	25	3	80x11-9	1	65	3
	2	40	2		2	-	-
I-2-5	3	30	3	I-2-11	3	35	2
	4	20	3		4	-	-
	5	50	3		5	-	-
	6	-	-		6	-	-
65x15A	1	50	2	77x4-32	1	-	-
	2	30	2		2	-	-
I-2-6	3	20	1	II-2-12	3	-	-
	4	-	-		4	-	-
	5	15	3		5	-	-
	6	40	2		6	-	-
65x23	1	15	2	77x23	1	-	-
	2	70	3		2	-	-
I-2-7	3	40	3	II-3-1	3	-	-
	4	50	4		4	-	-
	5	30	1		5	-	-
	6	50	3		6	-	-

Table 2
(cont.)

Height and pest damage for hybrid pines, 1984

Accession Rep/Row/ Position	Plant No.	Height (cm)	Pest Damage	Accession Rep/Row Position	Plant No.	Height (cm)	Pest Damage
4759	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
II-3-2	3	-	-	II-3-8	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
71x4-32	1	35	1	AxD	1	-	-
	2	-	-		2	-	-
II-3-3	3	-	-	II-3-9	3	-	-
	4	-	-		4	-	-
	5	20	2		5	-	-
	6	20	2		6	-	-
76x15A	1	20	1	65x15A	1	-	-
	2	35	3		2	-	-
SOP	1	-	-	II-3-10	3	-	-
	2	-	-		4	-	-
II-3-4	3	-	-		5	-	-
	4	-	-		6	-	-
AxD	1	15	1	62x23	1	-	-
	2	-	-		2	-	-
II-3-5	3	-	-	II-3-11	3	-	-
	4	40	5		4	45	6
	5	-	-		5	45	4
	6	-	-		6	-	-
Loblolly	1	-	-	AxD	1	20	1
	2	55	5		2	-	-
II-3-6	3	-	-	II-3-12	3	-	-
	4	60	4		4	-	-
	5	50	3		5	-	-
	6	-	-		6	-	-
AxD	1	-	-	4769	1	15	1
	2	-	-		2	10	1
II-3-7	3	-	-	II-4-1	3	-	-
	4	-	-		4	10	1
	5	-	-		5	15	1
	6	-	-		6	-	-

Table 2
(cont.)

Height and pest damage for hybrid pines, 1984

Accession Rep/Row/ Position	Plant No.	Height (cm)	Pest Damage	Accession Rep/Row Position	Plant No.	Height (cm)	Pest Damage
78x6-42	1	20	1	AxD	1	20	2
	2	20	2		2	25	2
II-4-2	3	-	-	III-4-8	3	-	-
	4	-	-		4	15	1
	5	-	-		5	15	1
	6	15	1		6	45	1
65x4-32	1	10	2	AxD	1	20	1
	2	-	-		2	20	3
II-4-3	3	-	-	III-4-9	3	-	-
	4	10	1		4	-	-
	5	25	2		5	20	2
	6	15	1		6	-	-
65x23	1	-	-	71x11-20	1	-	-
	2	-	-		2	-	-
II-4-4	3	30	2	III-4-10	3	10	1
	4	-	-		4	-	-
	5	-	-		5	10	1
	6	-	-		6	-	-
62x4-32	1	5	1	65x11-20	1	-	-
	2	-	-		2	-	-
II-4-5	3	-	-	III-4-11	3	15	1
	4	-	-		4	15	1
	5	-	-		5	-	-
	6	-	-		6	15	1
78x23	1	-	-	Pitch Plains	1	-	-
	2	-	-		2	-	-
II-4-6	3	10	1	III-4-12	3	-	-
	4	-	-		4	-	-
	5	-	-		5	30	4
	6	15	1		6	-	-
AxD	1	20	2	65x23	1	-	-
	2	10	1		2	10	1
II-4-7	3	10	1	III-4-13	3	20	2
	4	20	1		4	-	-
	5	20	1		5	-	-
	6	25	1		6	-	-

Table 2
(cont.)

Height and pest damage for hybrid pines, 1984

Accession Rep/Row/ Position	Plant No.	Height (cm)	Pest Damage	Accession Rep/Row Position	Plant No.	Height (cm)	Pest Damage
65x15A	1	15	1	4769	1	-	-
	2	-	-		2	-	-
III-4-14	3	-	-	III-5-5	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
62x4-32	1	-	-	62x11-10	1	-	-
	2	-	-		2	-	-
III-4-15	3	-	-	III-5-6	3	-	-
	4	25	2		4	-	-
	5	15	1		5	-	-
	6	-	-		6	-	-
78x4-32	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
III-5-1	3	-	-	III-5-7	3	10	2
	4	-	-		4	20	3
	5	-	-		5	15	1
	6	-	-		6	15	4
65x4-32	1	10	4	AxD	1	-	-
	2	-	-		2	-	-
III-5-2	3	-	-	III-5-8	3	-	-
	4	15	2		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
Loblolly	1	45	4	AxD	1	-	-
	2	45	4		2	10	1
III-5-3	3	20	3	III-5-9	3	-	-
	4	50	5		4	-	-
	5	65	4		5	-	-
	6	40	5		6	-	-
AxD	1	35	2	78x23	1	-	-
	2	-	-		2	-	-
III-5-4	3	30	3	III-5-10	3	-	-
	4	20	1		4	-	-
	5	-	-		5	-	-
	6	5	1		6	-	-

Table 2
(cont.)

Height and pest damage for hybrid pines, 1984

Accession Rep/Row/ Position	Plant No.	Height (cm)	Pest Damage	Accession Rep/Row Position	Plant No.	Height (cm)	Pest Damage
4756	1	-	-	79x7-56	1	15	3
	2	-	-		2	10	2
III-5-11	3	-	-	III-5-13	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
77x4-32	1	-	-	Pitch X	1	35	1
	2	-	-	Loblolly	2	40	1
III-5-12	3	-	-	III-5-14	3	25	2
	4	-	-		4	20	1
	5	-	-		5	30	2
	6	-	-		6	-	-
					7	25	-

1/Planted April 20 to May 13, 1982 on Cape May PMC, except Pitch X Loblolly which was planted April 12, 1983; Data recorded February 1.

2/A dash (-) indicates a dead tree.

3/Damage ratings: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe; Damage caused primarily by tip moths in previous year.

Table 3

Vigor and pest damage for hybrid pine accessions, 1984[1/]

Accession Rep/Row/ Position	Plant No.	Vigor[2/]	Pest Damage	Accession Rep/Row Position	Plant No.	Vigor[3/]	Pest Damage[4/]
62x4-32	1	-	-	Pitch plains	1	7	8
	2	-	-		2	-	-
I-1-1	3	-	-	I-1-7	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
4762	1	-	-	Loblolly	1	6	8
	2	-	-		2	-	-
I-1-2	3	-	-	I-1-8	3	6	8
	4	-	-		4	5	6
	5	-	-		5	-	-
	6	-	-		6	6	7
AxD	1	-		72x22	1	-	-
	2	9	8		2	-	-
I-1-3	3	-	-	I-1-9	3	5	5
	4	4	3		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
AxD	1	-	-	AxD	1	9	6
	2	6	7		2	6	5
I-1-4	3	6	7	I-1-10	3	-	-
	4	5	5		4	-	-
	5	4	3		5	9	8
	6	-	-		6	-	-
AxD	1	-	-	62x23	1	-	-
	2	-	-		2	-	-
I-1-5	3	7	7	I-1-11	3	-	-
	4	5	4		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
4756	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
I-1-6	3	7	1	I-2-1	3	-	-
	4	-	-		4	-	-
	5	-	-		5	5	5
	6	-	-		6	-	-

Table 3
(cont.)

Vigor and pest damage for hybrid pine accessions, 1984

Accession Rep/Row/ Position	Plant No.	Vigor	Pest Damage	Accession Rep/Row Position	Plant No.	Vigor	Pest Damage
62x22	1	5	7	65x4-32	1	-	-
	2	-	-		2	6	7
I-2-2	3	4	5	I-2-8	3	8	9
	4	9	9		4	8	8
	5	-	-		5	-	-
	6	-	-		6	8	7
67x22	1	7	5	80x6-22	1	6	5
	2	-	-		2	7	8
I-2-3	3	-	-	I-2-9	3	7	7
	4	8	6		4	6	7
	5	6	6		5	7	8
	6	-	-		6	-	-
77x23	1	8	9	AxD	1	9	7
	2	-	-		2	-	-
I-2-4	3	-	-	I-2-10	3	-	-
	4	5	5		4	8	7
	5	-	-		5	-	-
	6	6	6		6	-	-
77x4-32	1	9	8	80x11-9	1	7	7
	2	5	6		2	-	-
I-2-5	3	6	6	I-2-11	3	8	8
	4	8	7		4	-	-
	5	8	8		5	-	-
	6	-	-		6	-	-
65x15A	1	7	8	77x4-32	1	-	-
	2	5	6		2	-	-
I-2-6	3	-	-	II-2-12	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	7	8		6	-	-
65x23	1	8	7	77x23	1	-	-
	2	7	8		2	-	-
I-2-7	3	7	8	II-3-1	3	-	-
	4	5	6		4	-	-
	5	8	7		5	-	-
	6	5	7		6	-	-

Table 3
(cont.)

Vigor and pest damage for hybrid pine accessions, 1984

Accession Rep/Row/ Position	Plant No.	Vigor	Pest Damage	Accession Rep/Row Position	Plant No.	Vigor	Pest Damage
4759	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
II-3-2	3	-	-	II-3-8	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
71x4-32	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
II-3-3	3	-	-	II-3-9	3	-	-
	4	-	-		4	-	-
	5	8	6		5	-	-
	6	8	7		6	-	-
76x15A	1	9	9	65x15A	1	-	-
	2	8	8		2	-	-
SOP	1	-	-	II-3-10	3	-	-
	2	-	-		4	-	-
II-3-4	3	-	-		5	-	-
	4	-	-		6	-	-
AxD	1	8	7	62x23	1	-	-
	2	-	-		2	-	-
II-3-5	3	-	-	II-3-11	3	-	-
	4	-	-		4	7	8
	5	-	-		5	6	6
	6	-	-		6	-	-
Loblolly	1	-	-	AxD	1	7	2
	2	4	5		2	-	-
II-3-6	3	-	-	II-3-12	3	-	-
	4	3	5		4	-	-
	5	7	7		5	-	-
	6	-	-		6	-	-
AxD	1	-	-	4769	1	7	2
	2	-	-		2	-	-
II-3-7	3	-	-	II-4-1	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-

Table 3
(cont.)

Vigor and pest damage for hybrid pine accessions, 1984

Accession Rep/Row/ Position	Plant No.	Vigor	Pest Damage	Accession Rep/Row Position	Plant No.	Vigor	Pest Damage
78x6-42	1	-	-	AxD	1	9	9
	2	-	-		2	8	9
II-4-2	3	-	-	III-4-8	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	5	6
65x4-32	1	-	-	AxD	1	9	9
	2	-	-		2	-	-
II-4-3	3	-	-	III-4-9	3	-	-
	4	-	-		4	-	-
	5	9	8		5	-	-
	6	8	4		6	-	-
65x23	1	-	-	71x11-20	1	-	-
	2	-	-		2	-	-
II-4-4	3	9	9	III-4-10	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
62x4-32	1	-	-	65x11-20	1	-	-
	2	-	-		2	-	-
II-4-5	3	-	-	III-4-11	3	8	5
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
78x23	1	-	-	Pitch Plains	1	-	-
	2	-	-		2	-	-
II-4-6	3	-	-	III-4-12	3	-	-
	4	-	-		4	-	-
	5	-	-		5	8	7
	6	-	-		6	-	-
AxD	1	-	-	65x23	1	-	-
	2	-	-		2	9	3
II-4-7	3	-	-	III-4-13	3	-	-
	4	-	-		4	-	-
	5	5	5		5	-	-
	6	8	9		6	-	-

Table 3
(cont.)

Vigor and pest damage for hybrid pine accessions, 1984

Accession Rep/Row/ Position	Plant No.	Vigor	Pest Damage	Accession Rep/Row Position	Plant No.	Vigor	Pest Damage
65x15A	1	-	-	4769	1	-	-
	2	-	-		2	-	-
III-4-14	3	-	-	III-5-5	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
62x4-32	1	-	-	62x11-10	1	-	-
	2	-	-		2	-	-
III-4-15	3	-	-	III-5-6	3	-	-
	4	9	8		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
78x4-32	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
III-5-1	3	-	-	III-5-7	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
65x4-32	1	-	-	AxD	1	-	-
	2	-	-		2	-	-
III-5-2	3	-	-	III-5-8	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
Loblolly	1	8	8	AxD	1	-	-
	2	6	6		2	7	4
III-5-3	3	8	7	III-5-9	3	-	-
	4	8	9		4	-	-
	5	6	8		5	-	-
	6	7	8		6	-	-
AxD	1	7	8	78x23	1	-	-
	2	-	-		2	-	-
III-5-4	3	9	8	III-5-10	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-

Table 3
(cont.)

Vigor and pest damage for hybrid pine accessions, 1984

Accession Rep/Row/ Position	Plant No.	Vigor	Pest Damage	Accession Rep/Row Position	Plant No.	Vigor	Pest Damage
4756	1	-	-	79x7-56	1	-	-
	2	-	-		2	-	-
III-5-11	3	-	-	III-5-13	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
77x4-32	1	-	-	Pitch X	1	9	7
	2	-	-	Loblolly	2	9	8
III-5-12	3	-	-	III-5-14	3	-	-
	4	-	-		4	-	-
	5	-	-		5	-	-
	6	-	-		6	-	-
					7	-	-

1/Planted April 20 to May 13, 1982 on Cape May PMC, except Pitch x Loblolly which was planted April 12, 1983; Data recorded October 31.

2/A dash (-) indicates a dead tree.

3/Vigor ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

4/Damage ratings are: 1=None; 3=Slight; 5=Moderate; 7=Severe; 9=Very Severe.

Evaluation of *Solidago sempervirens*

34I023C

The vegetation behind the frontal dune along the mid-Atlantic coast is subject to pest dmage. Once a dune becomes stable, *Ammophila breviligulata* (American beachgrass), either planted or native , is the main species on sites north of Virginia Beach, Virginia. After a period of time, unidentified pests appear to reduce plant vigor and eventually kill entire stands. This phenomenon also occurs in Virginia Beach, even though beachgrass is not the dominant dune species. This decline may cause large "blow outs" and undesirable changes in the dune pattern. While deterioration of American beachgrass is a natural phenomenon, the invasion of long-lived native perennials into the weakened stand of beachgrass is a slow process. Present management techniques and available plant materials do not insure adequate dune cover.

Solidago sempervirens (Seaside goldenrod) is a salt tolerant perennial forb that often grows in association with American beachgrass. It is well adapted to the entire dune area along the mid-Atlantic coast growing from the crest of the foredune back through the woody climax vegetation in the back dune area. Plants produce several unbranched stems up to one meter high from short rhizomes and sometimes form open stands in the inter-dunal area. Seaside goldenrod can be used as a complimentary plant with American beachgrass and other species for sand dune stabilization.

During 1981, an assembly of ninety-nine goldenrod accessions were collected. Some of these accessions were vegetative material while others were seed. In the spring of 1982, seventy-nine of these accessions were planted in initial evaluation plots at Cape May. Based on performance evalution, the number was reduced to seventy in 1983 and further reduced to sixty-one in 1984.

Spartina alterniflora for Tidal Bank Stabilization

34I031F, 34I033F, 34I065F

Coastal sound banks and river estuaries which are exposed to storms and tidal action are a severe erosion problem along the mid-Atlantic coast. The problem is acute in the states of Virginia, North Carolina and Maryland and to a lesser extent in Delaware and New Jersey. The Soil Conservation Service has recognized shore erosion as a critical problem for many years. Previous efforts were mainly directed towards engineering structures and transplanting native cordgrasses from nearby marshes along eroding tidal areas.

In 1975, the shore erosion problem was designated as a high priority item for the Cape May PMC service area. The planned action was to be limited to saline waters and was divided into two phases; these being the stabilization of the intertidal zone and vegetation of the beach area above the tidal zone.

S. alterniflora (smooth cordgrass) is the only known grass that has potential for stabilizing the intertidal zone of saline waters along the mid-Atlantic coast. In 1977, an assembly of 111 accessions was planted on the PMC. From 1977 to date, the number of accessions has been decreased annually using the evaluation selection process. Currently, eleven accessions are being tested at two on-center sites and three off-center sites in two states. A fourth planting is scheduled to be established in the spring of 1986. Both bare-root and potted plants are being tested.

The objective of this project is to select a vigorous strain of smooth cordgrass to control erosion on tidal banks.

Assembly and Evaluation of *Uniola paniculata*

34I029C

Uniola paniculata (sea oats) is a perennial, long-lived sand stabilizing grass that is found along the Atlantic and Gulf Coasts south of Virginia Beach, Virginia. This grass is slow to establish but is known to have good persistence following establishment. It has a dense fibrous root system which makes it an excellent sand binding plant. The abundance of foliage on individual plants makes it a meaningful part of the foredune flora within its area of adaptation.

Ammophila breviligulata (American beachgrass) is now the primary grass that is planted for stabilization of sand dunes along the mid-Atlantic Coast for the areas north of the Virginia/North Carolina line. Unidentified pests have threatened the long term effectiveness of this species. An adapted variety of seaoats is needed for use in Maryland, Virginia and North Carolina where this problem exists.

In 1982, the Cape May PMC began a broad based assembly of sea oats which continued into 1983. Most of the seed collections were started in the greenhouse before transplanting to the field. To date, old plants or seedlings which survived throughout the winter at Cape May were either mulched in the field or moved to the greenhouse.

One vegetative accession (T-39013) which remained in the greenhouse throughout the winter immediately after collection and transplanted to the field the following spring is the only accession to bloom and produce seedheads. There are a total of 53 accessions in the sea oats assembly. Evaluations will continue to screen the accessions for winter hardiness and plant vigor.

Woody Plants for Sand Dune Stabilization

34I006C

There are many miles of unstable back dunes along the mid-Atlantic coast from North Carolina to Massachusetts. As a result of natural plant succession, some dunes will eventually become vegetated with woody species. This is a slow process, especially where man interferes with nature. The areas that are partially stabilized with woody plants allow sand movement to occur. While this isn't bad in itself, drifting sand from large unstable areas on the back dunes can develp into a serious problem. Woody plants adapted to this environment are not readily available from commercial nurseries for the restoration and protection of coastal dunes.

The objective of this project is to select one or more superior woody cultivar which will be readily adapted to the back dune area in MLRA 149 and 153 of the mid-Atlantic coast. This project began in 1979 when seed collections of four woody species were made from Georgia to Cape Cod, Massachusetts. The four species are *Myrica cerifera* (wax myrtle), *M. pensylvanica* (bayberry), *Rosa* spp. and *Prunus* spp. A total of 191 accessions were collected and planted.

In the spring of 1981, the *Rosa* spp. and *Prunus* spp. were transplanted to an initial observation site at the PMC. The *Myrica* spp., which require two years to develop an adequate root system for satisfactory transplanting, were transplanted into the initial evaluation plots in the spring of 1982, along with four late arriving *Rosa* accessions. Many of the wax myrtle were collected south of Maryland and did not tolerate the cold winter temperatures at Cape May.

No accession has been deleted for the *Prunus* and *Myrica* species to date. However, selections will be made at the end of the 1985 growing season. The rugosa rose has been narrowed down from 40 to 15 accessions.

SOIL CONSERVATION SERVICE
CAPE MAY PMC
PROJECT PLAN

I. PROJECT TITLE: Winter Cover Crop Species for Erosion Control in Spring Planted Vegetable Fields

PROJECT NO: 34I038K

Wind erosion has been identified as a serious problem within the Cape May Service Area. Up to this date, it has been difficult to decide how to approach a solution. Several species have been identified as potential windbreak types, yet, few non-woody plants have proved satisfactory for testing. The center will be evaluating several types of windbreaks to include windbreak pattern and species.

II. PROBLEM:
The problem is twofold. Damage results from airborne movement of sand during periods of sparse cover. The source areas are scoured while sand may be transported to undesirable locations, such as, field borders, roads, or farmsteads. Sand grains can injure young plants as they are transported from one location to another. This injury may be in the form of plant abrasion, breaking of the plant stems, uprooting, or overtopping of juvenile plants.

This project will address the need for windbreak systems and cropland management. It will include vegetables and other tender crops for the period immediately preceding planting date and the following 15-45 days. The problem exists in MLRA 133A, 136, 144A,

III. OBJECTIVE:
The objective is to evaluate cover crop species and management of these cover crops at planting time for the primary crop. When the best species and management practice is determined, the results will be incorporated into the Technical Guides.

IV. LITERATURE REVIEW:

V. PROCEDURE:

A. Plant cover crops in fall on appropriate date for good winter cover.

B. Test crop - Lettuce or tomatoes

C. Treatments: (12)

1. Wheat
   a. Strip tillage (plant in tilled area).
      (1) Kill cover crop with herbicide at planting time. (T-1)
      (2) Till out live cover crop about 30 days after vegetable was planted. (T-2)

   b. No-till
      (1) Kill cover crop at or before vegetable planting date. (T-3)

2. Rye 'Aroostook'
   Repeat the three treatments in V.C.1.

3. Barley - Repeat the three treatments in V.C.1.

4. Oats (fall planted spring variety).
   a. No-till: Plant in dead cover crop. (T-10)

   b. Strip tillage (T-11)
      (1) Plant in tilled area
      (2) Till out oats about 30 days after transplanting date.

5. Control (T-12)
   Conventional tillage methods.

D. Planting Plan:

1. Rows per treatment - 4
2. Row length - 20 feet
3. Row spacing - 3 1/2 feet
4. Plant spacing - Appropriate for variety.
5. Width of tilled area - 20 inches
6. Number of replications - 3
7. Number of treatments - 9
8. Row orientation - Perpendicular to prevailing wind direction.
9. Vegetable planting date - April 1 - May 1.
10. Duration - 1 year
    Duplicated for three years.

VI. MANAGEMENT:

A. Soils - Sassafras SL (0-3% slope)

B. Fertility: Fertilizer and lime will be applied for high management.

C. Pest control: Control will be only to extent necessary for effective evaluation of treatments.

D. Irrigation: Will apply water to maintain adequate soil moisture.

VII. EVALUATIONS:

A. Plant survival - No.

B. Plant vigor - (1-10)

C. Plant damage
   1. Physical (1-10)

   2. Soil overtopping - Depth in cm.

   3. Soil loss - Loss in cm.

D. Sand movement
   1. Into test area (1-10)
   2. Loss from test area (1-10)
   3. Use tubular sand traps and elevation stakes.

E. Effectiveness of treatment on:
   1. Preventing soil loss (or gain) (1-10)

   2. Practical method (1-10)

   3. Physical damage to test plants

VIII. APPLICATION:

Data will be summarized at the end of the project. Results will be evaluated for practical application and effective erosion control. Action will be taken to get techniques incorporated into State Technical Guides.

IV. COOPERATION:
Cook College, Rutgers University and College of Agriculture, University of Delaware.

Pest-resistant Plants for Secondary Dune Stabilization

34A012C

The objective of this project is to test several long-lived salt tolerant species for persistence behind the foredunes where Ammophila breviligulata (American beachgrass) stands have deteriorated due to disease or other problems. The study began in 1978 when the first planting was established at Island Beach State Park, New Jersey. In 1980 and 1981, additional plantings were made in Delaware and North Carolina.

Evaluations for the North Carolina Planting during 1984 indicated that Carex kobomugi (Japanese sedge) was the best of the nine accessions for stand, vigor and cover. PI-421238 Spartina patens (saltmeaodw cordgrass) was clearly the second best plant. 'Sea Isle' Japanese sedge was also superior to the other species during 1983 with 'Cape' American beachgrass being second best. No fertilizer has been applied to this planting since 1981. Under this low fertility condition, Sea Isle Japanese sedge and saltmeadow cordgrass both tend to out perform American beachgrass. Detailed documentation for plantings relating to this project can be found in previously published Annual Technical Reports.

Herbaceous Plants for Wildlife Food and Cover

34A014J

Several herbaceous species are available for the establishment of vegetative cover on critical areas. While these species provide good erosion control, their wildlife value is limited.

Solid stand of erosion control species often tend to discourage rather than encourage the use of these areas by small game and birds. Wildlife need plants for food, escape and nesting cover and travel lanes. A solid stand of one species will not provide all four elements for most wildlife.

Eight species of herbaceous conservation plants, with some potential for wildlife food and cover, were used to establish a wildlife planting in 1979. Each plot was 7 x 16.5 meters and replicated three times in a randomized plot design. Single species of legumes or grasses were used in each plot. No maintenance of any type was performed beyond the establishment period.

Lespedeza thunbergii 'VA-70' (shrub lespedeza), Eragrostis curvula (weeping lovegrass) and Festuca arundinacea (tall fescue) exhibited good stand 90 days after seeding while stand ratings for all other involved species were considered as fair.

In 1980, second year evaluations showed tall fescue, weeping lovegrass and L. sylvestris (flatpea) as the best three for stand performance. Spring regrowth was also better for tall fescue and flatpea.

Winter food for birds was rated best for P. virgatum (switchgrass) and L. cuneata 'Interstate' (sericea lespedeza) due to the abundance of available seed both on the plants and ground. Shrub lespedeza provided the best fall cover for small mammals while weeping lovegrass provided the best winter cover.

During the spring of 1981 and 1982, one-half of each plot was mowed to a height of 4 inches. Regrowth was good for all species, however, sericea lespedeza and switchgrass exhibited considerably better vigor during the summer and fall in the mowed area than in the non-mowed area. Weeping lovegrass, shrub lespedeza and switchgrass continue to provide the best wildlife cover for all seasons. Winter food for wildlife was rated best for switchgrass and sericea lespedeza. This planting was eliminated in the spring of 1983.

An additional wildlife planting was established at the PMC in the spring of 1981. Plots were seeded to mixtures of various grasses and legumes to determine the compatibility of seeded wildlife species with erosion control plants. Despite the strong competition from annual weeds, the planting was successful in becoming established, however, vigor was reduced considerably. The plots which were seeded to a mixture of switchgrass, weeping lovegrass and shrub lespedeza exhibited the best stand and vigor during the establishment year. However, during the four-year-period, other mixtures performed equally well or better when rated for wildlife value.

The objective of this project is to select conservation plants to improve the wildlife food and cover on critical areas which are seeded primarily for stabilization.

Evaluation of Ammophila breviligulata (American beachgrass) for Longevity
34A042C

Ammophila breviligulata (American beachgrass) is the primary dune grass species that is planted along the mid-Atlantic Coast for the initial stabilization of coastal sand dunes. It is salt tolerant and spreads vigorously by underground stems.

The variety 'Cape' which is superior in vigor and plant growth to other known varieties has been used extensively on coastal dunes from Maine to North Carolina. However, on many of these dune areas, established stands of Cape are relatively short-lived. Plantings consistently do well during the establishments year but sometimes decline in vigor during the second year and may deteriorate by the third or subsequent years.

American beachgrass varieties 'Bogue', 'Hatteras' and Cape were grown at the PMC to produce adequate stock for two field evaluation plantings. During the spring of 1984, one planting was established in Virginia Beach, Virginia and another in North Carolina. Initial survival for both plantings was excellent. However, a severe summer storm deposited approximately 12-18 inches of sand on the Virginia planting. This depth of sand drastically reduced the vigor for all three varieties but plant survival was unaffected. During the establishment year, the Bogue strain exhibited the least stem density and Cape strain the greatest. Cape exhibited the best vigor, while Bogue and Hatteras were about equal at second best.

The objective of this project is to compare the longevity of Cape to other American beachgrass varieties which are adapted to the mid-Atlantic Coast. The results will be used to determine whether one or more varieties of American beachgrass will be necessary for effective dune protection along the mid-Atlantic coast.

Myrica Species Planting Technique

FINAL REPORT

34C005C

Myrica spp. are native shrubs well adapted to sand dunes along the mid-Atlantic coast. These species are among the dominant woody plants immediately behind the foredune on many natural sites. They are excellent sand stabilizers and are vital to the environment of natural dunes.

While *Myrica* spp. are well adapted to sand dunes along the east coast, the survival rate of bare-root planting stock has been relatively poor. Two-year-old nursery grown seedlings of *M. pensylvanica* (baybery) are difficult to plant due to their huge top and root growth. yet, one-year-old seedlings are generally small and have an inadequate root system. Two-year-old seedlings of *M. cerifera* (wax myrtle) are somewhat smaller than the same age bayberry plants. When 2-0 stock of wax myrtle have been planted on the dune area, the survival rates have varied from very poor to excellent. A technique which would result in consistently high survival rates for bare-root bayberry and wax myrtle seedlings on sand dunes is needed.

This project began in the spring of 1980 by planting 1-0 and 2-0 seedlings of the two *Myrica* species on a sand dune. In 1981, another planting was made on an artificial, inland sand dune in Ocean County, New Jersey and repeated at a nearby site in 1982. Only 1-0 and 2-0 seedlings of bayberry and 2-0 wax myrtle were used in the 1982 Planting.

Other than the unsuitability of 1-0 wax myrtle, the results have been too variable to draw any conclusions.

Table 1

Second year dimensions for Myrica planting technique, 1983[1]
Clayton Site

Treatment/ Species/Rep.	Position[2]		Height (cm)		Width (cm)		Diameter (mm)[3]	
Super slurper								
Bayberry (1-0)								
I	5	10	15	15	10	10	4	3
II	8	9	10	30	5	15	5	4
III	1	4	20	25	20	20	4	4
Ave.			19		13		4	
Bayberry (2-0)								
I	2	8	15	5	5	5	3	2
II	5	-	35	0	50	0	6	0
III	3	10	25	10	40	20	7	3
Ave.			15		20		4	
Wax myrtle (2-0)								
I	6	9	35	15	30	20	15	3
II	3	6	35	10	10	5	7	1
III	2	9	15	15	10	10	4	8
Ave.			21		14		6	
Super slurper+Peat								
Bayberry (1-0)								
I	3	9	20	25	20	20	5	5
II	5	-	30	0	20	0	5	0
III	2	7	20	30	20	25	3	6
Ave.			21		18		4	
Bayberry (2-0)								
I	4	7	30	25	40	30	9	7
II	-	8	0	25	0	40	0	7
III	3	7	25	40	30	35	4	9
Ave.			24		29		6	
Wax myrtle (2-0)								
I	6	9	35	40	15	20	6	7
II	4	6	15	25	5	10	2	6
III	7	8	15	25	25	25	4	6
Ave.			26		17		5	

Table 1
(cont.)

Second year dimensions for *Myrica* planting technique, 1983

Treatment/ Species/Rep.	Position		Height (cm)		Width (cm)		Diameter (mm)	
Peat								
Bayberry (1-0)								
I	3	7	20	25	15	20	4	5
II	2	-	35	0	30	0	7	0
III	4	7	20	15	20	25	4	5
Ave.			19		18		4	
Bayberry (2-0)								
I	-	10	0	10	0	5	0	3
II	1	8	35	20	40	35	6	7
III	4	8	25	30	25	35	4	10
Ave.			20		23		5	
Wax myrtle (2-0)								
I	-	8	0	35	0	15	0	8
II	4	9	30	25	25	15	12	6
III	7	-	20	0	20	0	4	0
Ave.			18		12		5	
Clay								
Bayberry (1-0)								
I	-	-	0	0	0	0	0	0
II	-	3	0	20	0	5	0	5
III	9	10	20	20	10	25	3	6
Ave.			10		7		2	
Bayberry (2-0)								
I	7	8	45	20	35	15	7	4
II	5	7	20	30	20	25	4	6
III	5	8	30	20	25	45	5	6
Ave.			28		28		5	
Wax myrtle (2-0)								
I	-	8	0	25	0	20	0	6
II	3	-	30	0	5	0	8	0
III	-	8	0	15	0	20	0	3
Ave.			12		8		3	

Table 1
(cont.)

Second year dimensions for Myrica planting technique, 1983

Treatment/ Species/Rep.	Position		Height (cm)		Width (cm)		Diameter (mm)	
Control								
Bayberry (1-0)								
I	4	10	25	20	15	15	5	4
II	4	5	40	25	20	15	4	4
III	2	9	10	15	15	15	3	4
Ave.			22		16		4	
Bayberry (2-0)								
I	2	8	20	20	15	15	4	9
II	4	8	20	55	10	40	3	7
III	6	8	30	15	25	10	6	4
Ave.			27		19		6	
Wax myrtle (2-0)								
I	1	7	15	30	10	10	2	8
II	9	10	10	20	5	10	1	5
III	-	-	0	0	0	0	0	0
Ave.			12		6		3	

1/10 seedlings/treatment planted March 25, 1982 at Clayton Sand and Gravel Co. near Lakehurst, NJ; Data recorded September 13.

2/Positions within the row of the plants measured.

3/Diameter at soil line of main stem or largest stem of multi-stemmed plant.

Table 2

Second year fall evaluations for Myrica planting technique, 1983[1/]
Clayton Site

Treatment/ Species/Rep.	Survival (No.)	Vigor	Seed Production	Best 3 per Rep.
Super slurper				
Bayberry (1-0)		[2/]	[2/]	[3/]
I	2	7	10	-
II	2	8	10	-
III	3	7	10	-
Bayberry (2-0)				
I	2	8	10	-
II	1	4	10	-
III	3	5	10	-
Wax myrtle (2-0)				
I	2	3	10	3rd Best
II	4	5	10	-
III	4	6	10	-
Super slurper + Peat				
Bayberry (1-0)				
I	4	5	10	-
II	1	4	10	-
III	4	6	10	-
Bayberry (2-0)				
I	3	5	10	Best
II	1	4	10	-
III	4	4	10	Best
Wax myrtle (2-0)				
I	2	3	10	2nd Best
II	2	5	10	-
III	3	4	10	3rd Best
Peat				
Bayberry (1-0)				
I	4	6	10	-
II	1	3	10	-
III	6	5	10	-

Table 2
(cont.)

Second year fall evaluations for *Myrica* planting technique, 1983

Treatment/ Species/Rep.	Survival (No.)	Vigor	Seed Production	Best 3 per Rep.
Peat (cont.)				
Bayberry (2-0)				
I	1	6	10	-
II	2	7	10	-
III	5	5	10	2nd Best
Wax myrtle (2-0)				
I	1	2	10	-
II	2	5	10	2nd Best
III	1	5	10	-
Clay				
Bayberry (1-0)				
I	0	10	10	-
II	1	8	10	-
III	2	8	10	-
Bayberry (2-0)				
I	2	7	10	-
II	4	7	10	3rd Best
III	2	6	10	-
Wax myrtle (2-0)				
I	1	5	10	-
II	1	4	10	-
III	1	5	10	-
Control				
Bayberry (1-0)				
I	5	6	10	-
II	4	6	10	-
III	3	6	10	-
Bayberry (2-0)				
I	2	8	10	-
II	4	5	10	Best
III	2	8	10	-
Wax myrtle (2-0)				
I	2	4	10	-
II	2	4	10	-
III	0	10	10	-

Table 2
(cont.)

Second year fall evaluations for Myrica planting technique, 1983

1/10 seedlings/treatment planted March 25,1982 at Clayton Sand and Gravel Co. near Lakehurst, NJ; Data recorded September 13.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=None.

3/The best 3 treatments per replication based on vigor, amount of foliage, number of plants, size and overall appearance. Dash (-) indicates not among the best 3 for that replication.

Table 3

Third year fall evaluations [1] for Myrica planting technique, 1983

ASARCO Site

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
CONTROL [2]						
Bayberry (1-0)	[3]		[4]	[5]	[6]	[7]
I	40	45	9	5	10	-
	35	70	10			
	35	40	11			
Ave.	37	52	10			
II	45	70	15	4	5	-
	35	75	12			
	0	0	0			
Ave.	27	48	9			
III	0	0	0	4	5	-
	70	105	18			
	80	120	24			
Ave.	50	75	14			
Bayberry (2-0)						
I	55	55	16	5	4	-
	45	50	15			
	0	0	0			
Ave.	33	35	10			
II	55	65	12	4	4	-
	75	75	18			
	80	80	19			
Ave.	70	73	16			
III	0	0	0	4	2	3rd Best
	90	105	26			
	85	95	24			
Ave.	58	67	17			

Table 3
(cont.)

Third year fall evaluations
for Myrica planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
CONTROL						
Wax myrtle (1-0)						
I	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
II	40	45	9	3	10	-
	0	0	0			
	0	0	0			
Ave.	13	15	3			
III	0	0	0	4	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
Wax myrtle (2-0)						
I	0	0	0	6	8	-
	60	70	19			
	65	45	18			
Ave.	42	38	12			
II	0	0	0	6	10	-
	0	0	0			
	35	25	8			
Ave.	12	8	3			
III	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			

Table 3
(cont.)

Third year fall evaluations
for *Myrica* planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
SUPER SLURPER						
Bayberry (1-0)						
I	35	30	8	4	7	-
	55	75	12			
	30	30	9			
Ave.	40	45	10			
II	35	45	7	5	10	-
	50	65	13			
	45	50	9			
Ave.	43	53	10			
III	85	115	24	3	10	-
	50	55	12			
	60	75	12			
Ave.	65	82	16			
Bayberry (2-0)						
I	60	75	17	3	4	3rd Best
	40	70	9			
	60	60	16			
Ave.	53	68	14			
II	0	0	0	4	4	-
	65	50	15			
	70	75	25			
Ave.	45	42	13			
III	0	0	0	5	4	-
	75	95	20			
	0	0	0			
Ave.	25	32	7			

Table 3
(cont.)

Third year fall evaluations
for Myrica planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
SUPER SLURPER						
Wax myrtle (1-0)						
I	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
II	0	0	0	3	10	3rd Best
	0	0	0			
	0	0	0			
Ave.	0	0	0			
III	0	0	0	5	6	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
Wax myrtle (2-0)						
I	0	0	0	4	10	-
	60	75	26			
	0	0	0			
Ave.	20	25	9			
II	30	30	11	5	10	-
	0	0	0			
	60	35	14			
Ave.	30	22	8			
III	0	0	0	3	10	-
	25	20	8			
	55	60	19			
Ave.	27	27	9			

Table 3
(cont.)

Third year fall evaluations
for Myrica planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
SUPER SLURPER + PEATMOSS						
Bayberry (1-0)						
I	75	90	25	3	3	Best
	70	85	15			
	55	75	17			
Ave.	67	83	19			
II	55	60	15	4	4	-
	55	90	26			
	60	105	16			
Ave.	57	85	19			
III	80	120	16	3	3	-
	65	75	17			
	0	0	0			
Ave.	48	65	11			
Bayberry (2-0)						
I	0	0	0	4	7	-
	60	60	14			
	0	0	0			
Ave.	20	20	5			
II	60	45	12	3	6	2nd Best
	75	75	21			
	45	65	14			
Ave.	60	62	16			
III	100	115	28	3	2	Best
	110	120	28			
	90	140	24			
Ave.	100	125	27			

Table 3
(cont.)

Third year fall evaluations
for Myrica planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
SUPER SLURPER + PEATMOSS						
Wax myrtle (1-0)						
I	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
II	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
III	60	75	11	3	10	-
	0	0	0			
	0	0	0			
Ave.	20	25	4			
Wax myrtle (2-0)						
I	50	35	9	5	5	-
	50	70	16			
	0	0	0			
Ave.	33	35	8			
II	0	0	0	4	6	-
	0	0	0			
	75	95	25			
Ave.	25	32	8			
III	0	0	0	5	7	-
	0	0	0			
	60	45	14			
Ave.	20	15	5			

Table 3
(cont.)

Third year fall evaluations
for *Myrica* planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
PEATMOSS						
Bayberry (1-0)						
I	45	60	10	4	5	-
	70	105	20			
	0	0	0			
Ave.	38	55	10			
II	40	65	12	4	6	-
	45	65	15			
	40	75	10			
Ave.	42	68	12			
III	85	115	28	4	3	-
	50	80	15			
	70	95	21			
Ave.	68	97	21			
Bayberry (2-0)						
I	60	75	16	4	5	-
	65	40	12			
	55	80	19			
Ave.	60	65	16			
II	70	45	15	4	5	Best
	80	70	20			
	85	100	21			
Ave.	78	72	19			
	3/					
III	80	85	22	5	3	-
	80	80	18			
	70	75	23			
Ave.	77	80	21			

Table 3
(cont.)

Third year fall evaluations
for Myrica planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
PEATMOSS						
Wax myrtle (1-0)						
I	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
II	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
III	0	0	0	7	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
Wax myrtle (2-0)						
I	65	75	26	5	10	-
	50	55	16			
	65	55	18			
Ave.	60	62	20			
II	0	0	0	5	6	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
III	0	0	0	5	6	-
	0	0	0			
	50	50	14			
Ave.	17	17	5			

Table 3
(cont.)

Third year fall evaluations
for *Myrica* planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
CLAY						
Bayberry (1-0)						
I	50	85	15	3	4	2nd Best
	60	95	16			
	60	95	16			
Ave.	57	92	16			
II	65	75	21	4	4	-
	60	85	12			
	60	60	22			
Ave.	62	73	18			
III	0	0	0	3	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
Bayberry (2-0)						
I	50	60	11	4	4	-
	65	75	15			
	60	55	12			
Ave.	58	63	13			
II	75	95	20	4	3	-
	65	95	18			
	45	55	14			
Ave.	62	82	17			
III	90	85	22	4	2	2nd Best
	65	80	16			
	95	115	27			
Ave.	83	93	22			

Table 3
(cont.)

Third year fall evaluations
for *Myrica* planting technique, 1983

Treatment/ Species/Age/Rep	Height (cm)	Width (cm)	Diameter (mm)	Vigor	Seed Production	Best 3 per Rep
CLAY						
Wax myrtle (1-0)						
I	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
II	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
III	0	0	0	10	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
Wax myrtle (2-0)						
I	45	40	10	6	5	-
	65	50	15			
	75	100	25			
Ave.	62	63	17			
II	0	0	0	6	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			
III	0	0	0	4	10	-
	0	0	0			
	0	0	0			
Ave.	0	0	0			

Table 3
(cont.)

Third year fall evaluations
for Myrica planting technique, 1983

1/10 seedlings/treatment planted March 18, 1981 at ASARCO Mine near Lakehurst, NJ; Data recorded September 15.

2/Age at planting time.

3/Plant positions 2, 5 and 8 were measured (exception-Rep III, Bayberry (2-0), peatmoss is 4, 5 and 8). Missing plants were given a measurement of zero (0).

4/Diameter in millimeters of main stem or thickest stem of multi-stemmed plant at soil line.

5/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor; 10=Dead.

6/Seed production ratings are: 1=Very abundant; 3=Abundant; 5=Moderate; 7=Sparse; 9=Very sparse; 10=None.

7/Best 3 treatment/species/age combinations per replication based on vigor, amount of foliage, number of plants and size. A dash (-) indicates not among the best 3.

Revegetation of Sand Dunes

Binational Agricultural Research and Development (BARD)

34C024C

FINAL REPORT

Ammophila breviligulata (American beachgrass) has been successful for the initial stabilization of sand dunes. However, the long term cover is not adequate to prevent strong winds from blowing and depositing sand onto agriculture or other type lands. While American beachgrass is effective as a sand stabilizing plant, stands are often short-lived due to natural deterioration.

Salt tolerant plants which are persistent on sandy soils and can be interplanted with American beachgrass are needed to provide quality vegetation to prevent the blowing of sand onto prime lands. Proven fertilization methods are also necessary to increase the vigor of existing woody plants on sand dune areas.

The Binational Agricultural Research and Development (BARD) project was a cooperative effort between Israel and the United States. The project included projects in Israel and the states of Delaware, Virginia and California. The New Jersey portion of the project began in March 1981 near Fenwick, Delaware and Viginia Beach, Virginia. Two types of plantings were evaluated at each location during the establishment year. One study involved "Interplanting of long-lived herbaceous species with American beachgrass 'Cape'variety". These plantings were established on unstable sand dunes that had previously been vegetated with American beachgrass but were barren at planting time. The second situation was located on stable dunes that were partially covered with native perennial vegetation in a poor state of vigor. This study involved "An evaluation of the effect of fertilizer treatments on the invasion of long-lived perennial ground cover species and improved vigor of plant growth on mid-Atlantic sand dunes". Both of these studies were duplicated in 1982 under similar conditions. The five herbacous species which were interplanted with American beachgrass during 1981 were Carex kobomugi (Japanese sedge); C. arenaria (European sedge), Elymus arenarius (European wildrye), E. vancouverensis (Vancouver wildrye) and Panicum amarum (bitter panicgrass). Due to the poor performance of European sedge, it was not used in the 1982 planting.

The following is a final report concluding the cooperative effort between Israel and the United States for this project. However, the Cape May PMC will continue to evaluate and record data for the herbaceous study for at least one additional year.

5.1.3. In New Jersey

5.1.3 1. 1981 Planting

Initial plant survival was best for Elymus arenarius at both locations. The 30 day survival was 96% but had declined to 40% by fall (Table 5.1.3.1.). The initial survival for Carex arenaria was 11% and continued to decline throughout the year. The source of this accession is a sand dune near Kitty Hawk, North Carolina. Plants growing on the collection site are vigorous, providing good cover and spreading into adjacent areas. Apparently, this species is poorly adapted for transplanting. Due to poor performance, C. arenaria was eliminated from the 1982 planting. Only remmants remained in the old planting in 1982 and it was almost gone by 1983.

All other species maintained fair to good survival into late fall. The fall survival at the Virginia location was much lower than for the Delaware location, but may have been artifically depressed because of the later evaluation date. Fall survival was about 60% for C. kobomugi and Panicum amarum. Survival was 6%, 40% and 36% for C. arenaria, E. arenarius and E. vancouverensis, respectively. The stand of Cape continued to be excellent throughout the season.

Some mortality was experienced during the first winter. This loss was mainly the result of sand accumulation on the plants and sand loss which exposed the roots to the elements. Second year survival for C. arenaria, C. kobomugi, E. arenarius, E. vancouverensis, and P. amarum were 5%, 45%, 6%, 24% and 24%, respectively. While E. arenarius exhibits good initial vigor, persistence is short-lived.

Shortly after establishment, plant vigor was rated best (4.2) for E. arenarius (Table 5.1.3.1.). Unlike survival, vigor continued to be rated good into the fall season. However, vigor was rated poor (6.8) in the spring of the second year (Table 5.1.3.2.). Fertilization tended to have little effect on vigor ratings. By 1983, few plants of E. arenarius survived and seedlings did not volunteer to renew the stand. The interplanted species exhibiting the next best initial vigor was E. vancouverensis, followed by P. amarum and C. kobomugi. Regrowth for C. kobomugi and P. amarum is delayed following transplanting and first year spread is slow. This usually results in increased vigor throughout the first season. By fall, P. amarum displayed the best vigor for all interplanted species but was less vigorous than Cape.

Elymus species are cool season grasses. Therefore, these species tend to make most of their growth during the spring and early summer, are dormant in late summer and may recover in the fall. Both Elymus species tended to become less vigorous as the season progressed and further deterioration occurred over winter. Fertilizer applied in the second year did not significantly affect vigor for either species. By the end of the second year, the most vigorous species was P. amarum followed by C. kobomugi.

The following spring, vigor for the two Elymus species continued to decline while C. kobomugi and P. amarum were better than Elymus, but somewhat equal in vigor. In the spring of the second year, each planting was split into fertilized and control subplots. Fertilizer tended to increase vigor for all species, but was most effective for Cape. Regardless, whether the subplots were fertilized or not, P. amarum was clearly more vigorous than any other interplanted species.

In 1983, only C. kobomugi, P. amarum and Cape had sufficient plants for evaluation (Table 5.1.3.3.). All three continued to respond to fertilizer, but Cape exhibited the best response to fertilizer and the best vigor. C. kobomugi had overtaken P. amarum in vigor ratings. This observation is in agreement with other data indicating that C. kobomugi is slow to establish but may dominate a site after several years. This is especially noticeable on poorly managed dunes.

Culm density was recorded to measure spread and describe amount of cover. Density is recorded as the number of culms in one meter of row. During the establishment year, culm density for interplanted species was greatest for P. amarum. (Table 5.1.3.4). The density for this species growing in Virginia was two-fold compared to the values from Delaware. These data may be partially explained because Panicum spp. are warm season grasses and P. amarum is probably better adapted to the southern location. Culm density in Virginia was 17.7 compared to 8.7 for Delaware.

During 1982, an increase in stem density for each species resulted from the application of fertilizer over the control. P. amarum continued to have the greatest density (6.7) and the trend continued into 1983. While all density values are low, it must be pointed out

that the stands are less than adequate for effective dune cover. In 1983, the density increased for P. amarum but decreased for C. kobomugi. In this year, P. amarum responded to fertilizer while one would conclude that C. kobomugi did not. Culm density was not recorded for Cape, but visual observations indicated that the values would exceed 100.

Effective dune cover is one means of evaluating the performance of these grasses. The amount of cover in the fall of the establishment year and the following spring was insignificant for good dune protection for all interplanted species (Table 5.1.3.3.). Considerable variation in the amount of cover provided by Cape occurred across treatments. Total cover for Cape and interplanted species ranged from 15-30% in the spring of the second year. In the spring of the year following establishment, the average cover for Cape planted on a sand dune is expected in the 30-40% range.

Even by the third year, the interplanted species were not providing sufficient cover in the plots. Because of the poor stand, the interplanted species were only contributing about 10% of the total cover. However, where the stand of plants were adequate, the amount of cover for the interplanted species was increased from 10% to 25%. Yet, the data does not reflect this contribution. Fertilizer did not tend to increase the amount of cover for interplanted species. The poor stand of interplanted species is probably why the data indicates that the plants did not respond to fertilizer. One could assume that fertilizer would increase cover if an adequate stand of plants existed. The Cape plots responded to fertilizer in a dramatic manner. After two years, the Cape plants in the control plots were shorter, clumps were smaller, color was light green and appeared stunted when compared to the fertilized plants.

Volunteer seedlings were insignificant for all species during the period. The only species producing seedheads were the Elymus species and P. amarum. The seed of P. amarum is usually sterile at these locations and E. yancouverensis naturally produces few seedheads. E. arenarius produced small quantities of seed in both years. No seedlings of the interplanted species were observed in either planting in 1982 or 1983. This is not an uncommon phenomenon for herbaceous dune species.

The use of factual data is necessary to make actual selections, but visual observations are also useful in the evaluation process. Cape was superior to all interplanted species in every rating. This was anticipated in the establishment and following year, especially with the high level of fertilizer. P. amarum is clearly the best interplanted species (Tables 5.1.3.5. and 5.1.3.6). The second best interplanted species is C. kobomugi. Elymus species appeared to be poorly adapted to long term use on the dunes. C. arenaria is persistent but very difficult to establish. Due to the extremely poor stand, C. arenaria was not rated in 1982. (Table 5.1.3.7.).

Soil temperature, air temperature and wind velocities were measured in 1982 and 1983 for the Delaware locations. Several days were devoted to these measurements, yet, the data was of little value. The data was too variable to show any trend. There was not really any difference in air or soil temperatures inside or outside the plots. The stand of plants probably was not adequate to affect soil temperatures inside the plots. However, generally wind velocity measured at 10 cm above the sand was twice as great outside the plots as inside.

The pH values for both locations were somewhat acid, but within the normal range for sand dunes (Table 5.1.3.8.). The pH tended to increase following fertilization and plant establishment. The levels for P and K were exceptionally low at the beginning of the project. While the P level tended to decrease even with fertilizer additions, soil test analyses at very low ranges tend to be inaccurate. One would expect no real changes in the P level for this period. It is likely that most of the P either leached into the profile or was taken up by the plant while all of the K followed one of these routes.

5.1.3 2 1982 Planting

C. arenaria was eliminated from the 1982 planting because of poor survival in 1981. Also, the number of culms per planting unit was increased from two to three for each interplanted species. Initial survival for P. amarum was similar for both years (Table 5.1.3.9.). However, in 1982 the other three species had significantly lower

survival than in 1981. There was some variation in survival for each interplanted species between locations but no trend for better overall survival at either location.

Fall survival was relatively unchanged from the initial data. While initial survival for E. arenarius was better in 1981 (96% vs. 88%) fall survival was much better in the 1982 planting (62% vs. 40%).

Initial vigor for the 1982 planted species was somewhat better than in 1981 (Table 5.1.3.9). As was noted in 1981, E. arenarius exhibited the best initial vigor (3.3) while C. kobomugi was rated 5.3. C. kobomugi and P. amarum generally display low initial vigor due to their delayed spring regrowth date. By fall, both Elymus species had lost some of their vigor while the two other species were more vigorous. This is in agreement with the 1981 results. In 1983, there was little difference in vigor ratings for all interplanted species (Table 5.1.3.10). The trend, however, was for increasing vigor for P. amarum and C. kobomugi and decreasing vigor for the Elymus species. Of course, Cape was more vigorous at all evaluation dates than any interplanted species.

The trend for P. amarum to produce the greatest number of culms per unit area continued for the 1982 planting (Table 5.1.3.11.). The density during the establishment year for each interplanted species was slightly lower in 1982 than for the 1981 planting. These lower values are probably the result of sand accumulation on the 1982 Virginia planting. Sand accumulation did not begin in Delaware until the first winter.

From 1982 to 1983, culm density virtually remained unchanged for the Elymus species. There was a big increase in density during the second year for P. amarum as well as C. kobomugi. This increase more nearly reflects how these species actually perform than the 1981 data indicated. Fertilizer had more effect on P. amarum than C. kobomugi. This reinforces the theory that C. kobomugi can survive and provide cover under lower management levels than either Cape or P. amarum.

As was observed in the 1981 planting, the interplanted species provided very little cover during the year of establishment. Even into the second year, the interplanted species contributed less than one-half of the total cover. In fact, C. kobomugi contributed about 5% while Cape provided about 35% cover. Part of the low values reflect the poor stands of interplanted species. The cover provided by P. amarum was 18% which was about one-half of that provided by Cape. Realistically, the stand of P. amarum was poor compared with Cape, however, twice as many plants per unit area were planted of Cape as P. amarum.

Based on the planting densities of P. amarum and Cape, one could assume that cover was proportional inthe spring of 1983. Realistically, this probably is not a real fact. However, in the second year of the 1981 planting, this species provided more cover than C. kobomugi, but the cover provided by both species was considerably less for the 1981 planting than for the 1982 planting (Tables,5.1.3.3. and 5.1.3.10.).

By the fall of 1983, Cape provided the most effective cover but responded in a positive manner to fertilizer (Table 5.1.3.12). The stand of C. kobomugi in Delaware was poor. Sand accumulation in the plots was sufficient to partially bury many plants and kill part of the stand. However, in Virginia, C. kobomugi provided a significant amount of cover relative to Cape. This species also responded to fertilizer in a dramatic manner. This kind of response is not in keeping with previous data from this project and other work. P. amarum provided significant cover at both locations but only responded to fertilizer in Virginia. In fact, the unfertilized subplots in Delaware provided more cover than the fertilized ones. This can probably be explained by stand variation. The 1982 planting seems to reflect real cover more closely than data from the 1981 planting. If poor stands could be avoided, P. amarum or C. kobomugi probably can provide effective cover in stands of Cape by the third year.

5 1.3.3 Summary and Conclusion

Initial survival for E. arenarius was excellent and rivalled that of Cape. However, this species did not provide any significant cover in the second or latter years. C. kobomugi and P. amarum tended to have the best survival rate at the end of the establishment

year and were the only interplanted species that provided significant cover after the spring of the second year. There were differences in vigor for the two, but overall vigor was about equal.

None of the interplanted species provided significant cover during the establishment year. While the poor and spotty stands in some plots resulted in ill-behaved data, P. amarum and C. kobomugi provided cover during the second and third years. The response of these two species to fertilizer was not nearly so great as was the response of Cape. Stem density was greatest for P. amarum in all years.

Of the five interplanted species, only P. amarum and C. kobomugi appear to have potential to supplement Cape for sand dune cover. These are slow to establish and quick results cannot be expected. However, other plantings indicate that over a period of time, C. kobomugi can dominate dunes previously stabilized with Cape.

Based on excessive sand accumulation in some plots, one row of Cape should be planted rather than two. This might reduce sand accumulation in the establishment year and should result in improved stands of the interplanted species. This project reconfirms that maintenance fertilizer is required for Cape to retain vigor and provide adequate cover. While the interplanted species responded to fertilizer, both tended to spread in the absence of fertilizer.

Table 5.1.3.1

Vigor and survival for five interplanted dune stabilization species, 1981 [1/]

New Jersey

Species	Spring		Fall	
	Vigor [2/]	Survival (%)	Vigor	Survival (%)
'Cape' *Carex arenaria*	2.0 8.3	99 11	2.3 8.9	98 6
C. kobomugi *Elymus arenarius*	6.0 4.2	76 96	5.0 4.5	61 40
E. vancouverensis *Panicum amarum*	5.4 5.5	68 60	5.2 3.5	36 60

1/Plantings established in the spring at locations in Virginia and Delaware.

2/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor. Average for three replications.

Table 5.1.3.2.

Vigor for five interplanted dune species, 1982[1/]

New Jersey

Species	Date		
	May	Oct.	
		NF[2/]	F[2/]
'Cape'	4.3[3/]	6.0	4.0
Carex arenaria	5.5	9.0	8.5
C. kobomugi	5.0	6.2	4.8
Elymus arenarius	6.8	8.5	8.0
E. vancouverensis	6.4	7.0	6.5
Panicum amarum	5.4	4.8	4.3

1/Plantings installed in spring of 1981 in Delaware and Virginia.

2/Plots were split in 1982; ½ was fertilized with 75 kg/ha of N, P and K, remainder not fertilized.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor. These are averages for 3 replications at two locations.

Table 5.1.3.3.

Vigor and cover for interplanted species growing on a sand dune[1]

New Jersey

Species	Fertilized[2]				Unfertilized			
	Cover		Vigor		Cover		Vigor	
	F-82	S-83	F-82	S-83	F-82	S-83	F-82	S-83
	(%)				(%)			
'Cape'	52	50	4.0	2.0[3]	32	37	6.0	5.0[3]
Carex kobomugi	5	3	6.0	3.5	0	6	-	2.0
Panicum amarum	5	5	5.0	7.3	5	2	5.0	9.0

1/Five sand dune species and 'Cape' established in 1981 near Fenwick, Delaware.

2/All plots fertilized in planting year with 100 kg/ha of N-P-K; in 1983 fertilized subplots received 75 kg/ha of N-P-K.

3/Ratings are: 1=Excellent; 3=Good; 5=Fair; 7=Poor; 9=Very Poor.

Table 5.1.3.8.

Soil analyses on a sand dune[1/]

New Jersey

Location[2/]	pH[3/]		Mg		P		K	
	81	82	81	82	81	82	81	82
			kg/ha					
Delaware	5.1	5.4	9	6	10	3	7	12
Virginia	5.2	5.7	18	27	10	6	10	13

1/Planting medium is a coarse sand.

2/Samples taken spring 1981 before any fertilizer applied and spring 1982 before maintenance application.

3/1000 kg/ha of 10-10-10 applied in spring 1981 and five herbaceous species grown on plots.

Table 5.1.3.11.

Stem density for one and two-year-old plants on a sand dune [1]
New Jersey

Species	1982 [2]	1983 [2]	
		F [3]	NF
'Cape'	67.0 [4]		
Carex kobomugi	3.4	11.0	8.8
Elymus arenarius	4.2	4.3	4.5
E. vancouverensis	3.9	3.3	2.0
Panicum amarum	10.3	22.0	15.0

1/Plantings installed in the spring of 1982 in Delaware and Virginia.

2/Year of evaluation.

3/Plots were split in 1983; F = Fertilized with 75 kg/ha of N-P-K; NF = Not fertilized.

4/Number of culms per meter of row; Data recorded in the fall.

Table 5.1.3.12.

Effect of species and fertilizer on cover for sand dunes, 1983[1]

New Jersey

Species	Fertilized[2]		Unfertilized[2]	
	DE	VA	DE	VA
	(%)[3]		(%)	
'Cape'	60	35	40	31
Carex kobomugi	3	32	3	15
Elymus arenarius	0	0	0	5
E. vancouverensis	2	5	0	7
Panicum amarum	17	22	23	10

1/Plantings established at Fenwick, Delaware and Virginia Beach, Virginia in 1982; Data recorded in early fall.

2/Plots split in 1983: Fertilized = 75 kg/ha of N-P-K applied; Unfertilized = No fertilizer.

3/Percent of cover provided by each species for total area.

Effect of Fertilizer on the Invasion of Long-Lived Perennials

Prunus serotina (black cherry) and Myrica spp. are the dominant woody species for the 1981 Study at the Virginia location while Myrica spp. are clearly dominant at the Delaware location. There was not any significant change or even a trend in the dominant species during the first year. Total canopy and canopy afforded by each species did not significantly change. The amount of variation for canopy from spring to fall evaluation was greater within a fertilizer treatment than among treatments. While vigor was not clearly improved by fertiizer, the trend at the Virginia location was toward increased vigor with increases in fertility .

The second study for this project began in April of 1982. The two locations were the same as for the 1981 Study, however, the named species involved at the Delaware location were somewhat different while those for the Virginia location were similar.

While it became clear that the fertilizing assessment was of too short duration to obtain definite replies, the following facts have been noted:

1) Both evaluation methods by vigor and nutrient uptake by leaf analysis are valuable methods, especially the last one, for obtaining plenty of exact data of fertilizing experiments in sandy soils.

2) The main data obtained are:

   a) Different response of the species to fertilizing leading to their specific requirements: Examples:

      1) Woody plants react slowly to changes of nutritive uptake. But leaf analyses furnish already detailed information, as the positive relationship between phosphor rate and phosphor uptake for Myrica spp., and Vaccinium spp. in the first year.

      2) Potassium uptake of woody plants does not respond to fertilizer K O on sand dunes near the ocean, perhaps because of salt spray.

      3) Very few species have a positive plant and fertilizer rate relationship, as Vaccinium spp., although it has low values for plant P and K, probably being more tolerant to low fertility than other woody species.

      4) The natural flora near the ocean seems to show a certain independence upon nutrients, demonstrating their capability to grow in the poor sand, on the other hand, there are plants whose growth may be efficiently accelerated by fertilizing. For this purpose, more data need to be collected.

Overseeding of Cover Crops into Standing Conventionally Tilled Soybeans

34C049M

More than one-half of the soybean crop is planted into a conventionaly tilled seedbed. Winter-time erosion on some of these fields is excessive - unlike corn, soybean residue is fragile and usually inadequate for soil protection from water and wind erosion. Soybeans may be harvested too late to establish an effective winter cover crop. These two factors result in severe erosion on much of the conventionally tilled soybean land.

In 1983, three legume and two grass species were established by broadcasting the seed into standing immature soybeans previously established in conventionally tilled plots. The soybeans were drilled in thirty inch rows. The treatments were four planting dates, August 16, September 1, September 15, and October 14th and replicated three times. The test species were Trifolium incarnatum (crimson clover), Vicia villosa (hairy vetch), Medicago lupulina (black medic), Secale cereale 'Aroostook' (cereal rye) and Lolium multiflorum (annual ryegrass). Crimson clover resulted in extremely low performance throughout the 1983 study. This performance was attributed to the use of poor quality seed. The entire study was duplicated in 1984.

The objectives are (a) determine whether a cover crop can be established in standing soybeans, (b) which species will provide the best winter-time soil protection for harvested soybean fields, and (c) the ideal planting date for establishing that cover crop species.

The 1983 study showed that of the five species tested 'Aroostook'(rye) provided the most effective cover and the best seeding dates were between September 1 and September 15. The 1984 results are inconclusive at this time. A third planting is scheduled for the fall of 1985.

1984 SEED PRODUCTION

Name	Acc. No.	Production (Lbs.)
Lathyrus sylvestris	'Lathco'	428
Lespedeza thunbergii	'VA-70'	156
Lonicera maackii	'Rem-Red'	6
Panicum amarum	'Atlantic'	882.5
Panicum virgatum	PI-421138	230.6
P. virgatum	'Cave-in-Rock'	24.5
Secale cereale	'Balboa'	520
S. cereale	'Aroostook'	4,697
Medicago lupulina	T-30243	68
M. lupulina	'Various'	203
Triticum sp.		80
Avena sativa		82
Coronilla varia	'Chemung'	1,080
Glycine max	T-32183	108

1984 PLANT PRODUTION

Name	Acc. No.	Production (No.)
Ammophila breviligulata	'Cape'	39,900
Carex kobomugi	PI-433953	1,350
Elaeagnus umbellata	PI-421132	5
Juniperus conferta	'Emerald Sea'	417
Lespedeza thunbergii	'VA-70'	22
Lonicera maackii	'Rem-Red'	40
Populus x. spp.	Hybrid poplar	10 whips
Spartina alterniflora (Potted)		3,433
S. patens (Potted)		7,672
S. patens (Bare-root)		33,189
Tripsacum dactyloides		15

ENGLISH-METRIC CONVERSION

Conversion Table

1 inch	=	2.54 centimeters (cm)
1 foot	=	30.48 centimeters
1 yard	=	91.44 centimeters
1 pound	=	0.454 kilogram (kg)
1 acre	=	0.405 hectare (ha)
1 pound/acre	=	1.121 kilogram/hectare
1 bushel	=	0.352 hectoliter
100 centimeters	=	1 meter (m)

1 centimeter	=	0.394 inch
10 centimeters	=	3.94 inches
1 meter	=	39.37 inches
1 kilogram	=	2.205 pounds
1 hectare	=	2.471 acres
1 kilogram	=	0.892 pound/acre